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The Foundry and the Future

We have followed with much interest, but with little enthusiasm, the pronouncements of the various Ministers on the economic crisis. The major recommendations are increased exports, to be consequent on greater production and longer hours of work, decreased imports, especially timber, a slowing down of the housing programme, and generally increased austerity. Fundamentally, there is an assumption that there is an unlimited market for British goods. With the exception of coal, this is no longer true. Moreover, what markets there are now need cultivating, as many countries are in similar straits to our own. It is to be hoped that the intensified drive for exports will be more intelligently conducted than the famous 1946 effort. Motors specially designed for the mining industry exported and brought back ranked as a particularly bad case. Other examples were given at the time in an Editorial which we entitled " Popping the Tool Kit." This proposed increase in austerity will tend to cause inflation and make matters worse.

So far as the ironfoundry industry is concerned, there are three important impacts. One is that there is to be an increase in the number of hours worked —presuming, of course, there will be sufficient raw materials to admit of such a change. Then there is to be a slow-down in the housing programme. This will mean that there will be a seriously reduced demand from those foundries making builders' castings. Fortunately, a little of this production can be exported. This will, or should, release some foundry coke and scrap, but not much pig-iron, as high phosphorus iron is not in great demand by foundries making engineering castings. The planners must very quickly provide additional supplies of hematite, cylinder and refined irons, if increased production is to be attained. Finally, there is the staggering of working hours. This will cause endless troubles with the staff, wherever it involves interference with the settled habits of the individual. It will certainly ease the difficulties of the power stations and gas companies, but it will result in an increased, rather than a decreased, consumption of fuel. The crux of the whole matter seems to be fuel, yet no spectacular attempt has been made to induce miners to win the coal. We should have thought planned competitions for output giving really worth-while prizes, but not necessarily money, for single or group production records. Our contemporaries in Fleet Street would no doubt provide the ideas for the novelty of the awards. Imagination is necessary in this, as in every other crisis, but so far the Government has put forward nothing to arouse the enthusiasm of anybody.

Again, there has been no statement as to the making of serious reductions in the civil services for, so far, only the armed forces of the Crown are to be " axed." Normally, a man does not mind working hard to provide amenities for himself and his family, but traditionally he has always objected to helping to keep non-producers. In the past, it was Mr. Gradgrind's relations, but now it is this vast army of Government and municipal clerks. The foundry industry requires more plant, more incentives, both at the top as well as on the floor, associated with a minimum of controls. However, we are sure that the foundry industry will do its best to support the Government in any measure which they believe will eventually lead to a stable economy and a higher standard of living.

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Foundries of Yesterday

By T. H. Harris

Students of engineering history are conscious of the part played in the early days of the industrial revolution by the iron foundries of the period, but often there is but scant information available regarding these early establishments from which a picture of these pioneer foundries can be formed. True, such notable exceptions as Carron and Soho, come to mind, as well as perhaps that of Matthew Murray at Leeds, but very little is known about the remainder.

Information regarding a foundry of the early nineteenth century at Poulton, in Somerset, has recently come to hand which helps in forming an idea of the foundries of the period. Advertised for sale in the summer of 1818, it was described as "that commodious and extensive Iron Foundry . . . upon which considerable sums of money have lately been expended in completing the same with useful and convenient buildings and machinery, suitable for carrying on a large and extensive trade."

Situated in a central position in the midst of the Somersetshire collieries, and also the towns of Bristol, Bath, Frome, Warminster, Wells, Shepton Mallet and Brunton, from all of which it was about 12 miles distant, the vendor stated that "any person wishing to engage in the casting trade will find no manufactory in England so well adapted for the purpose of carrying on such a trade to their utmost satisfaction, being replete with every convenience to be wished for, and having a direct water communication with the Metropolis."

The buildings comprised a loam and drysand shop 60 ft. long by 40 ft. wide, with two very powerful cranes, and two air furnaces capable of melting six or seven tons or more if required; and two large stoves for drying the moulds, furnished with suitable carriages. There was also a greensand shop 40 ft. square with a small convenient crane; and two cupolas, both "blown by one of Streat's patent blowing engines and worked by a steam engine of two horse power."

A boring mill, driven by a water wheel 14 ft. diameter and 4 ft. wide, was said to be "capable of turning castings of any dimensions"; while to this was attached a large cast iron lathe for "turning any sort of casting," as well as a mill for grinding charcoal, blacking and coal dust.

The stock in trade included "dry and greensand flasks in great abundance; rings for loam work; several sets of rings for casting cylinders, shafts, etc., and in short every sort of material that is useful for facilitating the completion of orders to any extent."

Where the Paper Goes! We learn from *Ricerca Scientifica E Ricostruzione* that the British Council issues three series of publication:—(1) Monthly Science News—matter presented in simple non-technical language to the tune of 65,000 copies per month in the following languages:—English, French Spanish, Portuguese, and Arabic; (2) Science Comment, and (3) Science in Britain pamphlets. Can we afford it?

High-strength Cast Iron

Mr. Georges Delbart and Mr. Rubin Potaszkin have drawn the following conclusions in an article, *Contribution à l'Etude des Fontes Spéciales à Haut Résistance Mécanique*, printed in the June issue of *Fonderie*:—

Experiments carried out on a dozen casts of various types have shown up the influence of carbon and silicon contents on the mechanical properties and the tendencies towards porosity of special high-strength cast iron. Sound castings of a strength equal to, or in excess of, 25 tons per sq. in., associated with high shock strength, have been obtained with nickel-molybdenum alloys carrying carbon contents between 2.7 and 2.9 per cent. and silicon at a minimum of 1.7 per cent. The carbon content can be lowered to 2.6 per cent. by using an increasing quantity of silicon of the order of 2.3 per cent. Cast irons with lower carbons and silicons are characterised by higher mechanical properties, but their tendency is towards increased porosity.

This research has shown very clearly the beneficial results of inoculating with calcium silicide, which improves to a marked degree the overall mechanical properties. The influence of casting temperature on the castings has not been determined, but it does seem to have a profound effect on porosity, which is the more pronounced as the temperature is decreased.

Non-Ferrous Matters

Bulletin No. 9, just issued by the Association of Bronze and Brass Founders, is a publication of some magnitude. It has now reached about 40 pages. This section of the foundry industry is considering the question of the reopening of the London Metal Exchange. In general, the industry as a whole seems to favour this action. The Council are examining the "Conditions of Sale" issued by the C.F.A., as there may be differences in some requirements of the two sections of the industry. Other matters dealt with are fuel oil supplies, transport, electricity charges, and coke supplies. In the last case, consumers are expected to build up during the summer, a six weeks' stock, on allocation of the order of 90 per cent. of last year's deliveries. There is a good article on "Training Within Industry," and the Bulletin concludes with abstracts from new standard specifications and a list of Reports on German Foundry Practice.

The Light Metal Founder's Association have issued their second bulletin. It is very "newsy," and although limited to four pages, space has been found for a humorous note on parting powders. There is an important note that a well-known British enamel manufacture of real standing has developed a vitreous type of finish claimed to be suitable for application on aluminium castings.

FORD FOUNDRY ENGINEERS have devised a high frequency electric dust collecting system rated at 75,000 cub. ft. per min., probably the only one of its kind in any foundry.

Current Views on —— Precision Casting

Discussion at the Nottingham I.B.F. Conference

Two Papers, "The Precision Casting of High-melting Point Alloys Containing Nickel," by H. EVANS, A.Met., F.I.M., P. S. COTTON, B.Sc., and I. THEXTON, A.Met., A.I.M., and "Principles of Precision Investment Casting," by KENNETH GEIST and ROBERT M. KERR, JUN., formed the basis of a general discussion on this subject during the Nottingham Convention of the Institute of British Foundrymen. (See JOURNALS for July 3, page 205, and July 17, page 247.)

The CHAIRMAN (Mr. N. P. Newman) said that Mr. Evans, Mr. Cotton, Mr. Thexton and Mr. Dunlop would deal with any points raised in the discussion on the two Papers, and he was glad to say that Mr. Hudson (who projected the film illustrating the first Paper) would participate in the last part of the discussion.

MR. DUNLOP, opening the discussion on the Paper by Mr. Evans and his colleagues, said much of the work outlined in the Paper had been done when he was associated with Mond Nickel Company, Limited, but conditions at that time did not permit of full publication in the Paper which he gave in 1944 on precision casting. Some time ago, he had done a little work on a new development in silicon-ester type binder, which was due to Mr. Clifford Shaw and his colleagues. This was the control of gel formation by the use of condensing agents. At that time, piperidine was the condensing agent used, but he believed others had since been developed.

TABLE A.—*Mechanical Properties of Precision Cast Steels.*

Alloy type.	Condition.	Tensile Strength tons/sq. in.	Per cent. Elongation on $4\sqrt{A}$.	Diamond Pyramid Hardness.
0.2 per cent. carbon steel	As cast	25.6	35	136
	1½ hrs. 860 deg. C. O.Q.	30·8	18	199
	1½ hrs. 860 deg. C. O.Q. + 1 hr. 500 deg. C. O.Q.	30.0	23	128
3 per cent nickel-chrome case-hardening steel	As cast	40.8	8	238
	1 hr. 860 deg. C. O.Q.	58.4	2	361
	1 hr. 860 deg. C. O.Q. + 1 hr. 560 deg. C. O.Q.	51.2	4	305
12 per cent chromium, 0.35 per cent. carbon Stainless steel	As cast	72.0	3	380
	1½ hrs. 950 deg. C. O.Q.	72.0	3	495
	1½ hrs. 950 deg. C. F.C.	50.8	6	410
	1½ hrs. 950 deg. C. O.Q. + 1 hr. 750 deg. C. O.Q.	41·2	11	215
12 per cent. nickel, 25 per cent chromium, 3 per cent. tungsten stainless steel	As cast	40.0	21	182

O.Q. = Oil quenched. F.C. = Furnace cooled.

Mould Coating

While the spraying of the wax pattern was generally satisfactory, with some shapes it was not possible to coat satisfactorily all the surfaces, *e.g.*, inner surface of holes. Coating by dipping overcame this trouble and the following mixture was suitable:—

Pattern Dip Coating.—1½ lb. 100 C.M.L. sillimanite sand, 6 ozs. F.F. sillimanite sand, 280 ml. silicon ester containing 2 per cent. of piperidine. After dipping, the coated pattern should be dusted with 30-mesh sand and air-dried 20 hrs. before investing.

Mould Investment.—7 lb. sillimanite sand (four parts 30-mesh, one part *circa* 200), and 600 ml. silicon ester containing 1 per cent. of piperidine. This mixture had a volume of approximately 100 cub. in. On vibrating for about 1 to 2 hrs., the mould was consolidated and the excess liquid poured off. The volume of solid material was approximately 63 cub. in. After about 3 hrs. at room temperature, the mould should be heated for 20 hrs. at 45 deg. C.; that was, below the wax-melting point. This was in order to set the binder. The temperature should then be raised to about 135 deg. C. and held long enough to melt out the wax, an hour or so usually being sufficient. The wax was collected for re-use later. The de-waxed mould was then raised to about 900 deg. C. in 3 hrs. and held at that temperature for at least 2 hrs., when it would then be in a condition to receive the molten alloy.

Mr. Dunlop said he had used this technique satisfactorily for casting Monel, pure nickel, mild steel, stainless steels and cobalt-chromium base alloys.

Some years previously, as part of a programme of work on precision casting, he had determined the tensile properties of a few steels and high nickel alloys, the test-piece used being to the pattern of the No. 12 Hounsfield Tensometer tensile variety. The test-pieces were vertically cast and fed from the top end only. The mould temperature on casting was held within the range of 850 to 900 deg. C., and the castings cooled in the moulds to room temperature. No machining was done on the test-pieces.

Mr. Dunlop then submitted two tables. Table A, which recorded the tensile and hardness properties of 0.2 per cent. carbon steel; 3 per cent. nickel-chrome case-hardening steel; 12 per cent. chromium, 0.35 per cent. carbon stainless steel and 12 per cent. nickel, 25 per cent. chromium and 3 per cent. tungsten stainless steel, and Table B, which recorded the tensile and hardness properties of three grades of silicon Monel con-

Discussion on Precision Casting

taining respectively 1.5, 3 and 4 per cent. of silicon. Included in that table were the properties of precision cast nickel containing 0.09 per cent. carbon, 1.46 per cent. silicon and 1.36 per cent. manganese in the as-cast condition.

Present Limitations

In conclusion, Mr. Dunlop said he would like to sound a note of caution. While the process was very adaptable to practically any alloy, there were some very serious limitations and foundrymen should not mislead themselves by thinking it would do for anything and everything. It was ideally suitable for alloys which were difficult to produce by any other method. At the moment the process was very expensive indeed, but for certain alloys it was the only suitable method. In the case of alloys that could be readily machined, where one could tool up and machine in an automatic way, ordinary sand casting plus machining all over was cheaper, but for short runs of such castings, say 50 or 100, where it would be an expensive matter to tool up specially, this process was suitable. It was also suitable for very long runs in alloys that were difficult to machine or in shapes that were difficult to make in any other way.

MR. BROWN asked whether a turbine blade had been subjected to X-ray examination to prove that it was absolutely sound.

Replying to MR. BROWN, MR. EVANS stated that X-ray examination had been carried out to confirm the soundness of the castings made by the technique described, and reference was made at the end of the paper to this method of inspection.

MR. DUNLOP added that castings such as those which had been passed round the room for inspection had been produced in very substantial quantities and had been proved by the X-ray method. In reply to a further question, he said he was not in a position to give production figures.

MR. A. SHORT said his firm also X-rayed all blades actually, and tested 100 per cent. on experimental quantities, but this was scaled down to a routine 10 per cent. examination on the production line.

Hot-tears

MR. MARTIN, expressing appreciation of the two Papers, said this process was a comparatively recent departure in this country, but there were bound to be extraordinary developments during the next few years. One of the points that impressed him, and on which he would like further comment, was the apparent absence of hot tearing. Some blades had been handed round in which the contraction against the mould was hindered by a flange at each end. He had looked particularly at those blades and could see no sign of hot-tears right in the corners. He would be glad to know whether hot tearing had been experienced to any great extent, or whether it was perhaps overcome because the mould was hot.

TABLE B.—*Mechanical Properties of Precision Cast Nickel Base Alloys.*

Alloy.	Condition.	Tensile Strength Tons/sq. in.	Per cent. Elongation on $4\sqrt{A}$.	Diamond Pyramid Hardness.
1.5 per cent. Si Monel	As cast	29.5	35	149
3 per cent Si Monel	As cast	39.6	30	218
4 per cent. Si Monel	As cast	63·5	5	342
Nickel— 0·09 per cent. C, 1.46 per cent. Si, 1.36 per cent. Mn	As cast	21.9	48	125

They had been told that this was precision work, and the American Paper mentioned a possibility of working to 3/1,000ths of an inch, but he would submit that, in trimming a wax pattern with a hot spatula, it was not possible to be certain to that fine degree, and yet that is what they saw being done in the film. Was that only for the purposes of the film, he asked, perhaps to show what was in practice done by a more precise operation, or was it done in a place which did not matter? They could naturally expect different types of tolerance, according to the danger of distortion or of contraction taking place more in one direction than another.

On the question of casting threads, Mr. Martin said that apart from a split thread die, there were two ways in which one could get the pattern into and away from the investment. One could possibly unscrew the pattern out of the original die, but if that were done with a wax pattern, was there not very considerable danger? On the other hand, if working with a split die, there would surely have to be an exceptionally fine joint between the two dies, otherwise there would be a danger of feathers of wax going into the joint and spoiling the uniformity at the thread.

In conclusion, he wished to refer to the Clifford Shaw method with condensing agents. It seemed to him that, although there was a tremendous value in being able to solidify an investment without pouring off a quantity of superfluous liquor at varying stages, the Clifford Shaw method was very slow. They were up against an expense in any case. The ethyl silicate and all the ingredients were expensive, and if they had to wait something like 40 hrs. between putting on the investment material and carrying out the next operation, it was adding very considerably to the general expense of the process. He concluded by expressing his thanks to the joint authors of the Paper.

Casting Threaded Work

MR. DUNLOP, replying, said that he had certainly found hot-tears in mild steel. It was doubtful if the assembly which had been passed round the room could be cast in mild steel in that particular investment. It was a very strong investment, but one of the prime characteristics of the alloy in which the casting was made was its strength at high temperature, and it did not hot-tear, but he did not think that was due to any

virtue in the process. If it was cast in ordinary steel, he was pretty certain that hot tearing would occur.

On the question of flashing of threads, dies could be made very accurately, and after all, a die was not subjected to any real ill-treatment. American investigators had given some extremely high pressures which were used to obtain sound wax patterns—pressures of 30 and 40 lb. per sq. in. With an accurately machined brass die suitably clamped, flash was negligible, and threads could be cast which would go straight into a nut. Of course, it was not easy; there had to be a shrinkage allowance on the thread. A ¼-in. Whitworth thread had 12 threads per inch, and the wax patterns had 11¼ threads per inch, but the final casting came out at 12 threads per inch.

MR. MARTIN inquired what type of steel was used in that case.

MR. DUNLOP replied that it was not a steel, but a nickel-base alloy.

The Shaw Method

Referring to the Shaw method and the length of time involved, Mr. Dunlop said there was no longer time involved in the Shaw method than in the method which had been outlined on the screen. Forty hours from starting the mould to pouring the casting might seem a long time, but on a continuous process what did it matter? It only meant that for the first 40 hours no casting was produced, but at the end of that time the castings would be coming out of the hot furnace at the same rate at which they were being put in.

On the question of equipment, he thought he might amplify the method of heating the moulds. There was the batch type and continuous firing. In the batch type, the mould was charged into a cold furnace and brought up with the furnace. On a small scale that was all right, but on a production scale it was very wasteful. The usual method was to have rather a long furnace with room temperature at one end and the final firing temperature at the other, the moulds being pushed through. After all, said Mr. Dunlop, it took a long time to make an ordinary building brick, which cost far less than a mould, so he did not see any objection to 40 hours between starting the operation and finishing it.

A visitor asked if any work had been carried out using a split investment with a wax-coated metal pattern? It seemed to him to be very wasteful to use a wax pattern every time. He believed certain work had been carried out in Germany with a wax-coated metal pattern, and wondered if anyone present had any knowledge of that process?

Tolerances and Hot Tears

MR. EVANS thanked Mr. Martin for his appreciative remarks and said that the main purpose of the authors' work had been to develop a technique applicable to Nimonic 80 with a view, first to being able to recommend it for use on an industrial scale, and secondly to disclose the difficulties associated with the process.

He agreed with Mr. Dunlop that the subject of precision casting had not been covered completely and that there was still a need for much research work. With regard to the hot spatula, the Author said that the tool might not appear to be sufficiently delicate for joining the wax pattern to the wax feeder head in the case of close-dimensioned castings. He and his colleagues, however, had not spent a great deal of time in working out the tolerances to which the castings should be made, and had not worried whether they were ±2 or 3 per cent., and therefore the use of the spatula was quite acceptable. More delicate instruments, electrically heated, in the form of small soldering irons are, however, commonly used in industry. He agreed with Mr. Dunlop's answer about the time taken in the process. If the times set down for each stage of the procedure in their paper were added together it would appear that the process was excessively time-consuming. Nevertheless, since the process could be worked on the basis of a "shuttle service," the total time for the production of a number of batches was quite reasonable.

On the question of hot-tearing, as laboratory workers they were extremely interested in the phenomenon and of course it was well known that certain types of steels under certain conditions were susceptible to hot-tearing. So far they had not experienced trouble in Nimonic 80 castings, and for obvious reasons it was probable that, under the operating conditions, Nimonic 80 was not susceptible to it. Dealing with split moulds, he said that some work had been carried out by other investigators using metal and plastic patterns, and some of the results had been published in the Press.

MR. COTTON pointed out that the wax pattern was not entirely wasted, as the wax could be reclaimed.

Production Costs

MR. A. TIPPER said the Institute was very indebted to the authors for placing such interesting information on record, and he hoped that at a later date they would have some information from the production side to go with it. He welcomed the opportunity of making some comments on the production side. One or two speakers had remarked on the difficulty in handling the waxes to maintain accuracy. This was very obvious and was one of the reasons why it was a costly process. The plant for doing the work had to be specially designed for the job. Air conditioning and temperature control of the room were two things necessary to maintain accuracy, and accuracy was as essential as soundness in order to make the method a success. One of the remarkable features was how well young girls could handle the fragile waxes after a short period of practice. He instanced the case of a young hairdresser who was put on to the work and in a month was setting up the waxes on their runners better than a man who had been doing the work for six months. It was a question of knack and becoming accustomed to handling something that was very fragile. They knew from information available in the American literature that production had reached very considerable proportions, and he would recommend anyone interested in the process to study that literature, which gave some idea of the speed of production and of the type of work which was being made competitive with other processes.

E

Discussion on Precision Casting

As regards cost and the question of saving wax, the cost of making a wax on a production scale was very small indeed, and the ratio of recovery was fairly high. In that connection it had to be remembered that the character of the wax must be maintained, since the contraction and expansion characteristics of the wax, as well as of other materials, were important. Giving some impressions of his own with regard to cost, he said it compared very favourably indeed with the cost of making forgings in alloys such as the Nimonics, and could be considerably less. It depended to some extent on how many separate castings could be made in one investment. With small items, as many as 50 or more individual castings could be made on one runner in one investment block, so that by a flow process a considerable production could be obtained.

He could support Mr. Dunlop on a minor point which had been mentioned. After the spraying of a wax pattern, there was a tendency for the main investment to shrink away from the spray coating, but this could be overcome by dusting the still wet spray coating with a coarser material such as the rough dry investment.

In conclusion, MR. TIPPER said he felt that these Papers, together with the already large volume of American literature, would serve as a very good guide to anyone really interested in the process. There must obviously be a field for it in this country, but it meant quite a long period of small-scale production before one could be sure that it was going to lead to an economic method for any particular type of casting.

MR. DUNLOP, replying, said there was no doubt the question of distortion of wax presented a very big problem. That was particularly so three or four weeks previously, when there was a heat wave, but there were other materials which could be used, and in the American Papers reference was made to plastics. He produced some combs which had been made from plastic patterns.

A Cold Douche!

MR. F. HUDSON expressed his intention of throwing a spanner into the works before the discussion proceeded any further! He thought as foundrymen they ought to consider this process very carefully, and so far as he was concerned, the more he saw of it the less he liked it. There were limitations to putting it on a proper production basis. Most of the work done in this country had resulted from that done in America and brought here during the war. The foundries had copied the Americans and had done very little new work. Certainly we had modified the American technique and adapted it to the alloys in which we were interested in this country, but fundamentally production methods had not been altered, and he thought those methods were entirely wrong.

First of all, consider the pattern material. It was a costly, brittle wax, which could not be rammed up by mechanical methods. The mould had to be made from an invested material which was poured in the form of a cream or slurry. That material itself was costly and entailed a long and expensive drying schedule to get the final mould. In his opinion, the process would never really be a commercial one until in the first place they had developed a new pattern material capable of being used on, for instance, a power press. Possibly one of the plastic or celluloid-base materials, or one of the fusible metals, might serve, but it would have to be stronger than the present wax and one which could be used on a machine of some kind. Then, when they had developed the pattern, they would have to develop a new moulding mixture. He would like to see the development of a powder which would combine the pattern spray and the investment in the existing process, but which could be compressed or rammed up on a machine and containing a small percentage of binder which could be quickly dried. He thought graphite or one of the carbon materials might be an ideal medium for making the pressed-up moulds which he visualised.

Therefore, instead of following the process which had been acquired from America, he felt it would be better to do some fundamental work and really put the process on such a basis that articles could be produced on a mechanised lay-out at a lower cost, because at the present time these castings were too expensive for many applications.

In conclusion, he wished to emphasise the question of tolerance. He thought it would be agreed that on a production basis many engineers expected limits which a founder could not possibly meet. A plus or minus tolerance of three-thousandths of an inch was the best one could expect, and in future one should not expect closer tolerances than that.

MR. DUNLOP, replying to Mr. Hudson, said that while all the published work in this country appeared to follow the American pattern, he did not think they should let the opportunity pass without saying what other work had been done and was being done. In Britain, they did not publish it from the roof-tops, but there were quite radical developments and modifications which had already been carried out.

He was surprised that Mr. Hudson should have endeavoured to convince them of the necessity for getting a new pattern material. Why not eliminate the expendable pattern altogether? Taking a split die in his hand, Mr. Dunlop said the whole accuracy of the job depended on that split die. There was no reason why a die could not be made in two pieces of refractory and then put together. A die of that sort could be made by a ramming technique against a metal mould face and the two halves put together after treatment. It had been done in this country years ago.

Multiple Moulds

Commenting on the process, MR. HERON said that lost wax castings did not necessarily make precision castings, and that was a fundamental point which should be appreciated by everybody who tackled the process. Precision was what was sought, and if they were going to compete with the machine shop, they would have to put into the foundry the same control and methods of control that they had in the machine shops.

There was no reason why wax patterns could not be produced economically on a fast machine. His firm were doing it semi-automatically on a special machine which they had developed, and getting a very high rate of production, using a wax not affected by atmospheric temperature. He described the point of air conditioning as a "make-do," rather than tackling the basic problem of producing patterns which would withstand the ordinary working conditions of an average shop.

He regretted that Mr. Hudson should have said what he did about following American technique in this country. His (Mr. Heron's) company had started from scratch an entirely new technique, and apart from the fact that they used the lost-wax principle, they did not use any of the processes which were used in the States. He agreed with Mr. Hudson in saying that the Americans had adopted the wrong production basis in producing a vast quantity of small moulds with relatively few components in the moulds. His firm had moulds with over 300 blades in them, and had found that to obtain high productivity with small capital expenditure, the large mould, dealing with a large number of components per cast, was the answer. It gave a better control, and it was obviously better to have ten moulds each containing 300 blades than to have 300 moulds each with ten blades. He knew that the carrot, of the permanent refractory mould replacing a wax pattern, had been dangled in front of them for a long time.

MR. DUNLOP interpolated that he was not suggesting a permanent mould.

MR. HERON: Or a semi-permanent mould?

MR. DUNLOP: A mould used only once.

MR. HERON said it was difficult to bring together with a consistent degree of accuracy two metal surfaces, even though produced by the finest methods of machining and modern technique, but to produce two refractory surfaces which were subject to considerable thermal shock and had a thermal cycle which probably would have to go up to 1,000 deg. was a problem which he thought would take a long time to solve. He had seen some castings made from semi-permanent moulds and they looked very nice, but they were like some of those which the Americans brought over here, which also looked very nice, but when checked in the inspection department were found not to be precision castings. There was a big difference between precision castings and lost-wax castings. He repeated again, precision castings could be made by the lost-wax process, but just because one made lost-wax castings, it did not necessarily mean they were precise.

With regard to tolerances, his company had produced many blades to a very tight tolerance. It would be useful if they could work to a tolerance of plus or minus 0.003 in. It was practical on quite large components to hold to plus or minus 0.002 in., but tolerances were quite a subject in themselves because they varied so much with the shape and size and type of component, and with the materials used. Mr. Heron concluded by thanking the Institute for giving him the opportunity to be present and listen to the Papers and the discussion.

Joining Pattern and Feeding Heads

MR. SHORT said he did not think it was fair to ask for a closer tolerance in wax than could be obtained in die casting and, if one did achieve equal tolerance by the lost-wax process, one would be doing very well.

With regard to joining the wax pattern to the feeder with a hot spatula, it had been said that in doing that one actually melted the wax pattern itself. That was true, but on a production basis it was usually found that the feeder itself was built into the die, so that when one was joining the wax pattern to the feeder, the unmachined portion of the casting was not affected at all. On those castings which were exhibited, the point of the wax below the buttress was all feeder and was actually injected into the die, so that when you joined the two patterns together, you did not actually interfere with the casting proper at all.

On a large production basis, with various waiting times between different stages, it had been found that from receiving an order to final inspection of the cast it took eight or nine working days, but when working a process it was necessary to have a build-up of work. On a hot day, for instance, wax took longer to solidify and one operator would probably get only 80 to 100 wax patterns at a time, whereas on a cold day the same operator would get 300, and such a variation in production at one stage of the process affected the entire production, and as Mr. Dunlop had remarked with regard to the 40-hr. time lag, when one achieved quite large production, one found eight or nine days was reasonable.

Costs of Production

Mr. Short said that up to the present time all the Papers that had been written on precision casting had dealt with the chemical or laboratory aspect, but he hoped that before long somebody would venture to give some production figures. He always stood rather in awe of the metallurgical chemists because they bewildered him with theory, but he wished to point out that the raw material of the mould before them on the table cost 12s. and the metal itself in the mould was produced at a cost of 6s., so to produce those two castings cost 18s., so if one produced a good casting—and he said "if" because percentage of scrap was high—if you got a good casting it had cost 9s., and it was necessary to show something which warranted such a high cost of production when you could get a lot of machining done for £1. He did not intend to go into figures in detail, but he could assure those present that the blades which were on the table cost £7 14s. each 12 months ago, with the high percentage scrapped due to the process. They were very much in the hands of the chemist with regard to controlling hydrolysis, and every casting thrown away meant another 12s. on the overheads. Actually the price of that particular blade had been brought down to 33s. in the last 12 months. Mr. Heron had spoken of casting 300 in a mould, which would obviously reduce the proportion of raw material in the mould per blade and thereby considerably reduce the cost of each blade, but even so the raw materials used in the process at the moment were expensive, and

in the very near future they would have to tackle the question of reducing the over-all cost of production.

MR. DUNLOP said they were all indebted to Mr. Short for those enlightening figures. He (Mr. Dunlop) had already pointed out that it was an expensive process, and now they knew just how expensive it was, but there was hope. Work was being done, and could be done, to cheapen it, but there was yet a long way to go.

MR. REYNOLDS suggested that it would be better, having regard to the difficulty of controlling the solidification of the wax owing to varying day temperatures, to control it by playing a current of air on to or through the mould.

MR. EVANS said that obviously Mr. Hudson and the authors had discussed this problem on many occasions and he thought that Mr. Hudson's very apt challenge could be answered by those representatives in the audience of companies who were actually producing precision castings by the lost-wax process on a large scale. They could supply the answers to the questions —how was the process working in industry? Was it giving profitable yields?—and so on. After all, as had already been stated, there was still a considerable amount of intensive research to be carried out, but the authors felt that they had reached a useful stage in being able to recommend a technique which could be operated on a large scale. It was true, as stated in the American paper, that the process had been used before the Christian era, and now it was 1947, so that it could be said that the process had been rediscovered and taken up by the foundry as an industrial process. Mr. Evans thought that although they were in a foundry atmosphere at the meeting they should not allow the process to assume such proportions that it became too important in relation to other processes. It should take its proper place by the side of processes such as die-casting and production of components by powder metallurgy.

Special Committee Suggested

MR. DUNLOP said he hoped the Chairman of the Technical Committee was present, because he wanted to suggest that the Institute should set up a committee to look into the process. Obviously, there was much information which ought to be made known, and still more to be discovered. It was one thing for people with the resources of Mond Nickel Company, Limited, behind them to work on the process in a small way, but the real economics of the process had got to be inquired into. As Mr. Evans had said, that could only be done in the foundry, and he would suggest that at least the possibility should be considered of setting up a sub-committee of the Technical Committee to look into the whole matter. (Applause.)

MR. MCRAE-SMITH, M.A., replied that, in the absence of the Chairman of the Technical Committee, he did not think he was out of order in saying that the possibility of appointing a sub-committee to consider precision casting had been suggested and was now before the Committee for consideration, but he was afraid they were not going to get very far unless the maximum amount of co-operation was forthcoming from those interested in precision casting.

DR. NEWELL pointed out that the British Iron and Steel Association had set up a group to deal with the matter of precision casting, and that this group had already held one meeting. As Mr. Evans had remarked, it was a subject which still required a considerable amount of research, and the Research Association therefore thought it was a matter in which they could be of assistance. Linking their efforts as closely as possible with the Institute, as they always endeavoured to do, they felt that they might undertake some of the more fundamental research work for the foundries as a whole. He, personally, would welcome any suggestions or ideas as to how an increase in the rate of development of the process in this country might be effected, particularly as regards co-operative development for the benefit of all interested in the subject.

MR. MCRAE SMITH, supplementing his previous remarks, said that the matter had rather been left on the table until the American Paper was published. The Technical Council had hoped to get some first-class information from the Paper, and then the matter was to be further discussed.

Vote of Thanks

The CHAIRMAN, moving a vote of thanks to Mr. Evans, Mr. Cotton, Mr. Thexton and Mr. Dunlop, said he would like to associate with it the name of Mr. Hudson, who had thrown out a challenge which the Chairman hoped would have its effect by interesting the Technical Committee in this important subject, on which they had had most interesting Papers and discussion.

MR. SHORT said he felt that some among the audience were wondering what others were doing in the lost-wax process, and it was gratifying to know that information such as they had had at that meeting was being printed so that they could all obtain the benefit of each other's research.

MR. REYNOLDS, supporting, said there seemed to be operating a certain amount of diffidence lest they should get to know too much about one another's processes. Probably there were dozens of foundries in the country nursing the same secret. He for one had long been an advocate of disclosing a lot of information not previously disclosed. He read the American technical Press, and was amazed at the amount of information the Americans were prepared to disclose as compared with the firms in this country. Many attempts he had made to get into other foundries had met with failure, although his firm was prepared to show people their foundry. That sort of spirit, he said, would not get them anywhere, and he suggested that those interested should get together, both firms and the various institutes, and hammer out their difficulties and not be so secretive. There was nothing to gain by secrecy, and the sooner they learned to work together as they did during the war, the better for all.

MR. EVANS, thanking the members on behalf of his colleagues and himself, extended to Mr. Reynolds and all present a hearty welcome to the Mond Laboratories. MR. DUNLOP issued a similar invitation to visit the Rolls-Royce works.

Some Notes on the Surface Drying of Moulds*

By A. Cracknell and F. Cousans

(*Continued from page* 315.)

Moisture Removal from Surfaces

For this part of the work, it was thought desirable that many of the variables associated with production moulds should be avoided, such as variations in surface area, shape, etc. Thus it was decided that experiments should be carried out on a standard size box (18 in. square by 6 in. deep), which was rammed up similar to a production mould, but with top and bottom surfaces flat. Unit sand was used throughout, and, in order to emulate production moulds as much as possible, the upper surface was painted with mould paint.

To ensure that the ramming of the boxes was as uniform as possible, the weight of sand per cubic foot, after ramming up the box, was determined. The moisture determinations of the mould surface, during drying, were made by means of a "Speedy" moisture tester. The relative humidity of the shop atmosphere was estimated with a wet and dry bulb thermometer.

It was realised that if the work was going to be of value in the foundry, besides determining the rate at which moisture dried out of the mould under different conditions, it was also necessary to determine at what rate the moisture "struck back" to the surface of the mould. To do this it was decided to determine the moisture content of the surface $\frac{1}{8}$ in. of the mould during the period following skin drying.

Originally the intention was that the effect of varying the two factors independently (air volume and temperature) upon the time taken to dry a mould should be determined, but, due to the skin-dryer being required for production moulds, and not being always available for experimental work for more than half-hourly periods, it was not possible to run the apparatus at any pre-determined temperature. In consequence, a full set of figures in which the temperature was varied and the volume of air kept constant, or the volume of air was varied and the temperature kept constant, and the corresponding effect on the time taken to dry the mould, were not then available.

Determination of Moisture Gradients

During these experiments, it was realised that although it was being established how quickly the moisture was drying out of the surface of the mould, little information was being obtained as to the extent to which moisture was being dried out of deeper layers, *i.e.*, to what depth moisture was removed from a mould during skin drying and also, though not a direct problem in skin drying, what changes in moisture gradients occur in a mould which was left to stand after it had been skin dried.

(*Note.*—Moisture gradient will be used to denote the change in moisture content of the sand as a function of the distance from the exposed surface of the mould.)

The method of determination was as follows:—A 2-in. diameter and slightly over 2-in. long sample was trepanned from the mould.

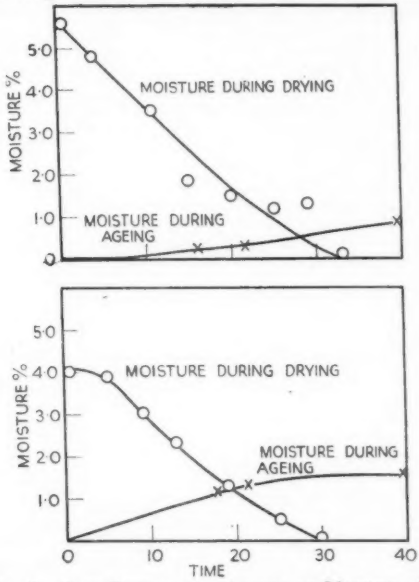


FIG. 9.—SKIN DRYING AND AGEING OF MOULDS. FOR DRYING TIME READ MINS.; FOR AGEING READ HOURS.

MOULD No. 1.—Box, 18 in. sq. × 6 in. deep (painted); weight of sand, 145 lb.; surface area of mould, 324 sq. in.; volume of sand, 1,944 cub. in.; volume of air per min., 520 cub. ft.; T° of air, 215 deg. C.; drying time, 33 min.; shop humidity, 47 per cent.; sand, H_2O 5.3 per cent., G.C. 7.9 lb., P 230; mean humidity during ageing, 50 per cent.

MOULD No. 2.—Box, 18 in. sq. × 6 in. deep (painted); weight of sand, 137 lb.; surface area of mould, 324 sq. in.; volume of sand, 1,944 cub. in.; volume of air per min., 460 cub. ft.; T° of air, 215 deg. C.; drying time, 30 min.; shop humidity, 49 per cent.; sand, H_2O 5.5 per cent., G.C. 7.9 lb., P 230; mean humidity during ageing, 57 per cent.

* A Paper presented at the Nottingham Conference of the Institute of British Foundrymen.

Surface Drying

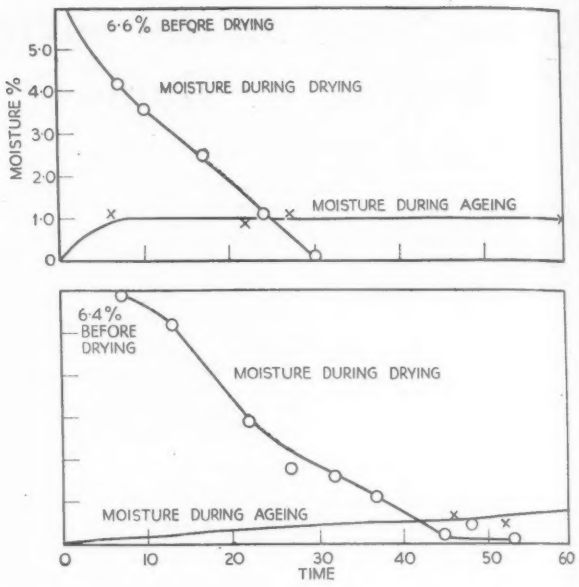


FIG. 10.—SKIN DRYING AND AGEING OF MOULDS. FOR DRYING READ MINS.; FOR AGEING READ HOURS.

MOULD NO. 3.—Box, 18 in. sq. × 6 in. deep (painted); Weight of sand, 137 lb.; surface area of mould, 324 sq. in.; volume of sand, 1,944 cub. in.; volume of air per min., 390 cub. ft.; T° of air, 215 deg. C.; drying time, 30 min.; shop humidity, 65 per cent.; sand, H_2O 5.1 per cent., G.C. 7.7 lb., P 200; mean humidity during ageing, 64 per cent.

MOULD NO. 4.—Box, 18 in. sq. × 6 in. deep (painted); weight of sand, 138 lb.; surface area of mould, 324 sq. in.; volume of sand, 1,944 cub. in.; volume of air per min., 200 cub. ft.; T° of air, 215 deg. C.; drying time, 63 min.; shop humidity, 54 per cent.; sand, H_2O 5.7 per cent., G.C. 7 lb., P 200; mean humidity during ageing, 63 per cent.

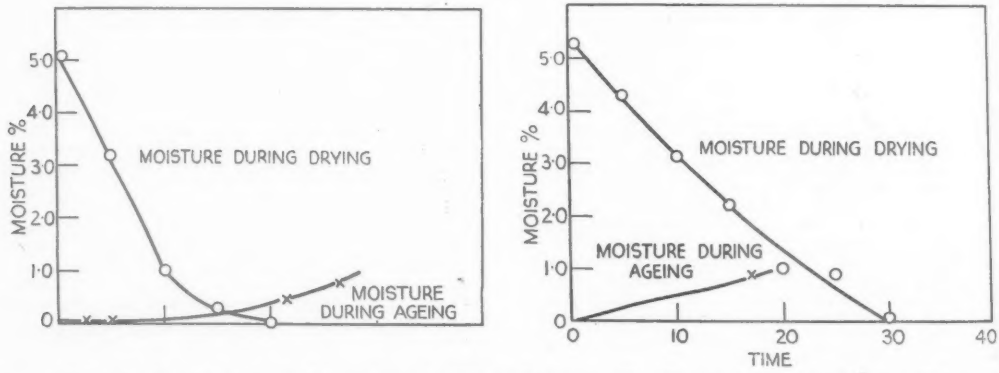


FIG. 11.—SKIN DRYING AND SUBSEQUENT AGEING OF MOULDS. FOR DRYING TIME READ MINS. FOR AGEING READ HOURS.

MOULD NO. 5.—Box, 18 in. × 6 in. deep (painted); weight of sand, 129 lb.; surface area of mould, 324 sq. in.; volume of sand, 194.4 cub. in.; volume of air, 530 cub. ft. per min.; T° of air, 270 deg. C.; drying time, 20 min.; shop humidity, 56 per cent.; sand, H_2O 5.2, G.C. 7.1, P 200; mean humidity during ageing, 70 per cent.

MOULD NO. 6.—Box, 18 in. × 6 in. (painted); weight of sand, 134 lb.; surface area of mould, 324 sq. in.; volume of sand, 194.4 cub. in.; volume of air, 460 cub. ft. per min.; T° of air, 225 deg. C.; drying time, 30 min.; shop humidity, 50 per cent.; sand, H_2O 5.5, G.C. 7.1, P 210; mean humidity during ageing 75 per cent.

The length of the sample was then reduced to 2 in. by pushing a plug inside the trepanning tube of such a length that a cylinder of sand 2 in. long was left inside the tube, the excess sand being cut off with a spatula. Thus, by pushing other plugs of increasing length into the tube from the side away from the surface portion, it was possible to cut off slices of uniform thickness in which the moisture content could be determined with the "Speedy" moisture tester. Since the same plugs were used almost throughout this investigation, then the moisture contents of the corresponding slices might be used for comparison purposes.

In practice it was found that the slices should be thinnest near to the "surface" of the sample, since the moisture content there, and consequently of the mould surface, changes very rapidly with respect to depth. The plugs used in this investigation gave slices of thickness (working from the surface) of $\frac{1}{4}$ in., $\frac{1}{4}$ in., $\frac{1}{4}$ in., $\frac{1}{4}$ in.,. $\frac{1}{4}$ in., $\frac{1}{4}$ in. For purposes of graphical representation of the results, the average moisture content of the slice was assumed to be the moisture content at the mid-point of the slice.

As will readily be seen, if moisture gradients in a mould are determined before and after the skin drying, then the point at which the two curves meet, represents the depth to which the mould has been dried. Similarly, the area between the two curves will be directly proportional to the quantity of moisture which has been dried out from the mould. For purposes of

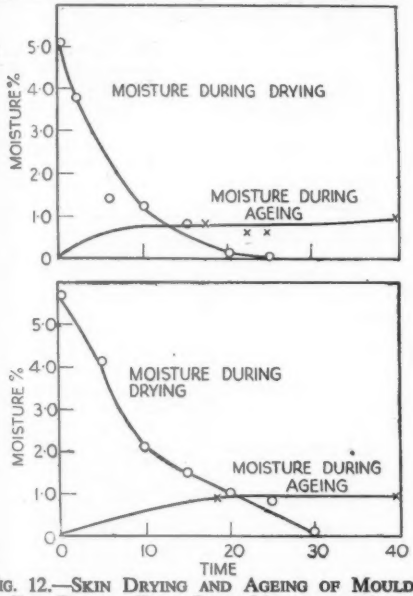


FIG. 12.—SKIN DRYING AND AGEING OF MOULDS. FOR DRYING TIME READ MINS.; FOR AGEING READ HOURS.

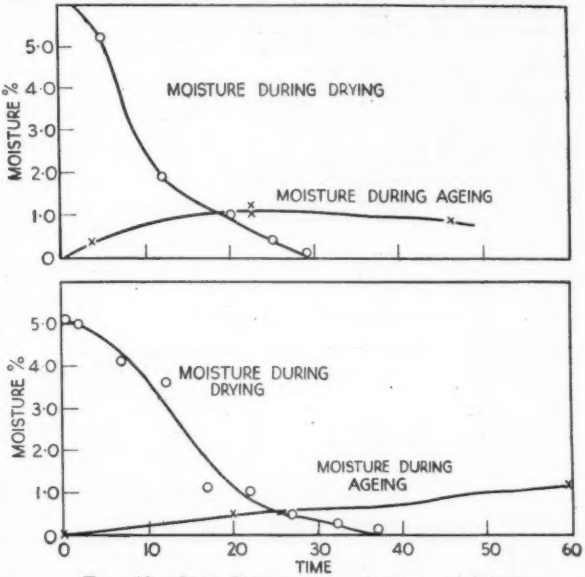


FIG. 13.—SKIN DRYING AND AGEING OF MOULDS. FOR DRYING TIME READ MINS.; FOR AGEING READ HOURS.

MOULD No. 7.—Box, 18 in. sq. × 6 in. deep (painted); weight of sand, 133 lb.; surface area, 324 sq. in.; volume of sand, 1,944 cub. in.; volume of air per min., 390 cub. ft.; T° of air, 240 deg. C.; drying time, 20 min.; shop humidity, 55 per cent.; moulding sand, H_2O 4.6, G.C. 5.9 lb., P 225; mean humidity during ageing, 67 per cent.

MOULD No. 8.—Box, 18 in. sq. × 6 in. deep; weight of sand, 126 lb.; surface area, 324 sq. in.; volume of sand, 1,944 cub. in.; volume of air per min., 196 cub. ft.; T° of air, 245 deg. C.; drying time, 30 min.; shop humidity, 65 per cent.; sand, H_2O 4.9 per cent., G.C. 6.3 lb., P 230; mean humidity during ageing, 66 per cent.

MOULD No. 9.—Box, 18 in. sq. × 6 in. deep (painted); weight of sand, 133 lb.; surface area of mould, 324 sq. in.; volume of sand, 1,944 cub. in.; volume of air per min., 505 cub. ft.; T° of air, 215 deg. C.; drying time, 29 min.; shop humidity, 61 per cent.; moulding sand, H_2O 5.4 per cent., G.C. 6.2 lb., P 230; mean humidity during ageing, 68 per cent.

MOULD No. 10.—Box, 18 in. sq. × 6 in. deep (painted); weight of sand, 138 lb.; surface area of mould, 324 sq. in.; volume of sand, 1,944 cub. in.; volume of air per min., 476 cub. ft.; T° of air, 245 deg. C.; drying time, 37 min.; shop humidity, 54 per cent.; moulding sand, H_2O 4.8 per cent., G.C. 6.2 lb., P 180; mean humidity during ageing, 61 per cent.

Surface Drying

comparison it is not necessary to know the absolute quantity of moisture which has been dried out of a mould, since it is sufficient to work in terms of the area between the two curves, *i.e.*, in "inch per cent. units," provided that the area of the mould is the same in all cases.

Incidentally, by knowing the bulk density of the sand in the mould, it has been found that the moulds used in this investigation lose 0.011 oz. of water per sq. in. of mould surface for each inch per cent. between the curves.

The figures obtained have been tabulated and graphs are included which show how the moisture content of the surface $\frac{1}{8}$ in. of the mould changes during drying under widely varying conditions. Graphs

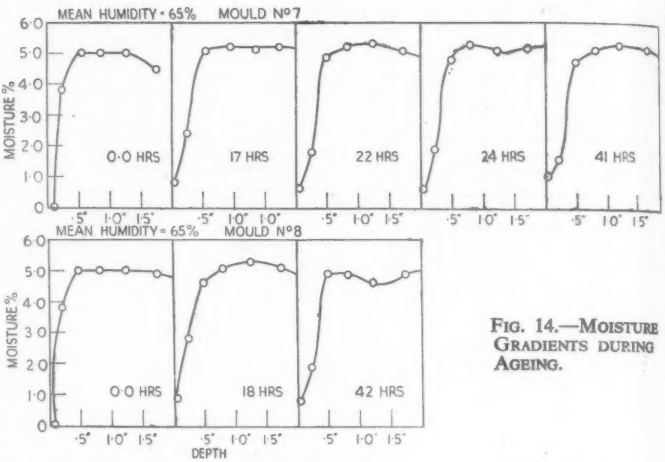


FIG. 14.—MOISTURE GRADIENTS DURING AGEING.

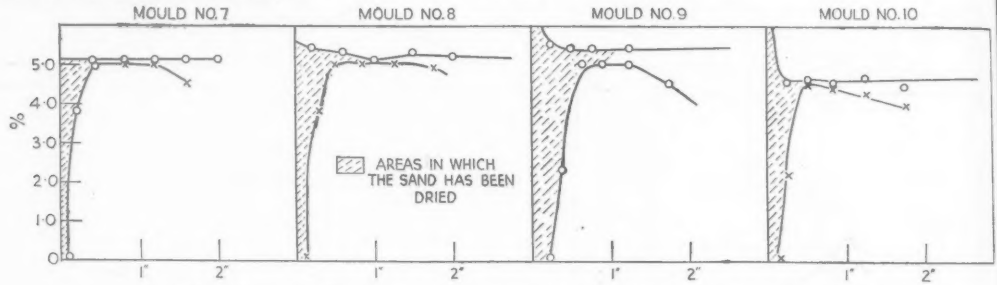


FIG. 15.—MOISTURE GRADIENTS IN SKIN-DRIED MOULDS BEFORE AND AFTER DRYING.

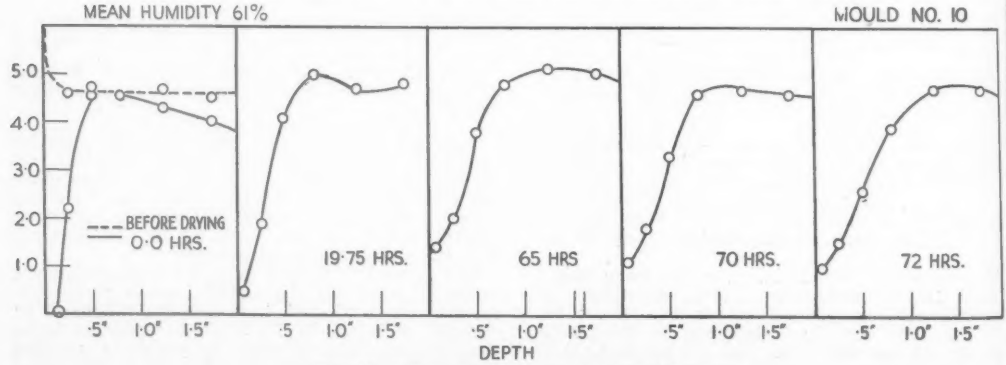


FIG. 16.—MOISTURE GRADIENTS DURING AGEING.

are also included, showing the moisture gradients of some of the moulds, before and after drying and during ageing.

Results

As with production moulds, temperatures of air in excess of 300 deg. C. again caused spalling of the surface of these moulds, but, unfortunately, this phenomenon could not be quantitatively assessed.

(a) Notes on the drying of the surface ¼ in. of the mould.

In general, the rate of drying appears to be quicker, the higher the moisture content, and slows down appreciably when the moisture falls below 2 per cent. A complete set of figures could not be obtained, owing to shop conditions, but data collected for moulds dried at approximately 215 deg. C. appear to indicate that there is an optimum rate of air flow which gives the maximum rate of drying (at approximately 180 cub. ft. per min. per sq. ft. of mould surface).

(b) Notes on the striking back of moisture to the surface of a mould.

Initial results obtained by the determination of the moisture content of the surface ¼ in. showed that, during ageing, the moisture content rises fairly rapidly up to 1 per cent. and then remains fairly constant at that figure. This appears to be, and indeed, is, contrary to the generally accepted theory that the moisture content at the surface of a mould rises to a value much nearer to its original moisture content when it is left to stand for any prolonged period of time.

This result is further confirmed by the determination of moisture gradients during the ageing of moulds. These show that the moisture content at the surface of the mould not only rises up to approximately 1 per cent., but also the moisture in the mould continues to dry out from the back layers of the mould. What appears to happen is that the moisture content of the layer in contact with the atmosphere rises to some critical value about 1 per cent. (which depends upon the atmospheric conditions, *i.e.*, relative humidity and temperature of the shop and the permeability of the mould) due to moisture being absorbed from the shop atmosphere, or to it creeping forward from the back of the mould, and this critical value is maintained. The rate at which the moisture evaporates, balances the rate at which it creeps forward, the net result being, that drying out continues and a certain concentration of moisture is maintained in that part of the mould in contact with the atmosphere.

There would appear to be an advantage in leaving a skin-dried mould to stand, because of the subsequent air drying. This should, of course, be qualified, inasmuch as the properties of the surface might be impaired by this 1 per cent. moisture, but experience has since shown that it has not been found possible to measure any change in properties by ordinary methods. Skin-dried moulds have been left standing for more than a week and then cast successfully, whereas, prior to these results being obtained, it was common practice to skin-dry a mould twice, if, after the first drying, it was left to stand for any period of time, or, on occasions, the aged moulds were scrapped.

Moisture gradients determined before skin drying show that there is a very high concentration of moisture near the surface of the mould due to application of the mould paint, whilst comparison with moisture gradients after drying shows that there is little or no effective drying at distances greater than ¼ in. from the surface of the mould. A layer at the surface of the mould, about ¼ in. thick, is dried completely, and as the distance from the surface of the mould increases, the moisture content rises very rapidly, to a value approaching its initial value at about ¼ in. from the surface.

It should be noted that these moisture gradients, before and after drying, do not meet, and indeed get further apart, as the distance from the surface of the mould increases. This is probably due to the fact that when a sample was trepanned from a mould immediately after drying, it was fairly warm and, since the determination of the moisture gradients took between 20 min. and half-an-hour, some degree of air-drying could occur during that period. However, the effect of this air-drying would not be so marked on the surface layers of the sample, since these values were determined first. Thus, for purposes of considering the effectiveness of skin-drying, it was felt that the method was sufficiently accurate. (See Figs. 9 to 16.)

(*To be continued.*)

Book Reviews

Practical Cost Accounts (Fourth Edition), by Andrew Miller. Published by Gee & Company (Publishers), Limited, 27-28, Basinghall Street, London, E.C.2. Price 12s. 11d. post free.

This book, now in its fourth edition, deals in a general, yet orderly, manner with the various factors which govern the institution and operation of a costing system. It is put forward as a textbook and each chapter is completed by the reprinting of examination questions set by the professional bodies connected with the study of this subject. Arrangement for the ready availability of reference charts is to be commended.

V. C. F.

Production Costs and Estimates, by Andrew Millar. Published by Gee & Company (Publishers), Limited, 27-28, Basinghall Street, London, E.C.2. Price 13s. post free.

The first edition of this book was published in 1924 as "Technical Costs and Estimates." This new edition has two extra chapters, while the whole has been subject to a thorough revision. The author has done well to select a cast-iron and a bronze propeller to illustrate his argument as to the equitable distribution of overheads. An excellent notion which has been incorporated in this book is the printing of the charts in a booklet attached to the inside of the back cover. Written in clear English, this book has everything to recommend it as an introduction to the study of production costs.

V. C. F.

Assessing Metal Values

By "Onlooker"

During the past few weeks, the march of events has shown that a system at which people grumble, but accept as workable, is much to be preferred to one which creates doubt and confusion among the business community. In September, 1939, the London Metal Exchange closed its doors by order of the Government, and a Controller of Non-Ferrous Metals was appointed to administer a scheme for obtaining and distributing copper, lead and zinc to users in the United Kingdom. Licensing was introduced, and after initial teething troubles, this wartime method of covering the needs of the industry settled down to a successful career. Bulk purchasing had arrived, and throughout the war it gave a good account of itself. Moreover, after an upward price adjustment in December, 1939, a remarkable run of fixed prices was seen, so that consumers were relieved of all anxiety regarding fluctuation in the value of their raw material. Rightly enough this was acclaimed as the millenium, but the more far-sighted members of the industry knew that it was too good to be true, and that in due course economic factors would reassert their sway. Nevertheless, there was an outcry from many directions for the retention of fixed prices, and since unvarying quotations had come to be accepted during the war as an integral part of the non-ferrous trade, any alternative to this was unacceptable. In consequence, it became fashionable to decry pre-war methods of trading and particularly to blame the Metal Exchange for the ups and downs in metal prices. By some critics, gambling and excessive speculation were adduced, while others apparently held the belief that the Metal Exchange itself fixed the daily quotations.

Functions of a Commodity Exchange

These misconceptions are all the more curious if one reflects that the conduct of all commodity markets is on very much the same plan, *i.e.*, the exchange is no more than some convenient gathering place for traders interested in the buying and selling of a product, whether animal, vegetable or mineral. At the beginning of the war, London's metal market closed down because the Government stepped in as the sole dealer, and this rang the knell of free and open trading which had previously been the custom. Now it seems that there is a realisation of intolerable conditions in the non-ferrous industry, for the price structure is breaking up and nobody knows at what point in the coming fall stability will again accrue. In these circumstances there is a feeling of helplessness in the face of impending disaster, and even those worst informed on the functions and operations of the Metal Exchange would like to see the system of daily prices revived again. One may well wonder about this lack of knowledge regarding such an important centre, but the fact is that the trade in pre-war days never bothered much over how the machinery of price fixing functioned, being content to accept the daily quotations as part and parcel of everyday business. Now they learn that even with Government approval, starting up again is not going to be easy and they are disturbed and even disgruntled about this hitch in the progress to normality. Let it be said at once that the Metal Exchange has never pushed itself, for the various members, dealers as well as brokers, handled a lot of business, much of it coming from abroad, and they were never sufficiently pressed to make it necessary to institute any sort of compelling drive for new clients.

At the time, this was probably a drawback for certain manufacturers and other traders who would have benefited from hedging operations on the market, and in the event it has proved to be a disservice to the Exchange itself, which would have had more friends during these years of closure if the facilities it offered had been more openly displayed. In its appraisement of the operations of the Rubber Exchange reopened last January, the Government, while providing for a watching brief to be held by the Bank, conceded the principle that a measure of speculation, which may be likened to investment buying, was necessary if the market was to operate satisfactorily. This certainly shows that the authorities have the right idea, but it is also a fact that gambling is to be deplored and stamped out entirely if possible. With this end in view, the Committee of the Metal Exchange has strengthened its powers by amendment of the rules.

Ring Members' Activities

The actual "chaffering" on the Metal Exchange is in the hands of the ring members or dealers, who execute the orders entrusted to them by their principals and by the brokers acting for clients. Ring members are not allowed to deal for their own account. As to the establishment of the daily prices, these are the result of the business done in the ring and are therefore a true reflection of the world's assessment of metal values. This must mean that the manufacturers secures his raw material at an equitable figure, for the producers and merchants always accepted the Metal Exchange quotations. It means, too, that there is always the facility to protect a position by hedging with a minimum of loss in view of the relative stability of the London prices over longish periods. It should be remembered that hedging can include buying to cover a sale, for which the physical copper will not be needed until some months have elapsed, as well as in selling forward "paper" so that a current purchase not balanced by an order from a customer does not remain at risk. But let no one conclude that Whittington Avenue was a "paper" market, for in pre-war days dealings in standard copper were backed by a tonnage of rough copper lodged in official warehouses, and the same goes for lead, zinc and tin; it was possible to tender metal against a sale or to take delivery as the result of a purchase. Most metal people are coming to the conclusion that our terminal markets should be restored, but it would be well if the machinery of these exchanges were more fully understood.

Bath Imports

Mr. Wilmot, Minister of Supply, informed Mr. Hogg on Monday that 2,379 baths of French and 4,000 of Hungarian origin had been imported at £14 each, while 3,000 baths had been exported at £8 each.

I.L.O. Industrial Committees

Iron and Steel and the Metal Trades

Two of the seven international committees set up by the governing body of the International Labour Office to deal with conditions in major industries will hold their second sessions shortly. The Iron and Steel Committee will meet on August 20, and the Metal Trades Committee on September 2. Both meetings will be held in the Parliament Buildings, Stockholm.

Each of the seven committees is of a tripartite character, consisting of representatives of the governments, employers and workers of the countries most directly concerned with the respective industries. The general terms of reference of each committee are to consider the present social problems of its industry and future international co-operation on social policy and its economic foundations in the industry. The committees have authority to recommend action on the part of the employers' and workers' organisations concerned in the various countries, as well as to recommend action by the I.L.O.

The Iron and Steel Committee held its first session in Cleveland, Ohio, in April of last year, and the Metal Trades Committee in Toledo, Ohio, in the following month. At the coming sessions they will receive reports on developments since those meetings, and will also consider the following questions:—(1) Regularisation of production and employment at a high level; (2) minimum income security (annual and other wage systems designed to provide assured earnings; and (3) labour-management co-operation.

The following have been nominated to attend these meetings as representatives and advisers from the United Kingdom.

Iron and Steel Committee:—Government representatives: Mr. S. G. Holloway, assistant secretary, Ministry of Labour and National Service, and Mr. T. Stanes, assistant secretary, Ministry of Supply (Iron and Steel Board); employers' representatives: Col. J. M. Bevan, chairman, Briton Ferry Steel Company, Limited, and Mr. R. Mather, chairman, Skinningrove Iron Company, Limited; employers' advisers: Mr. J. Ross, president, Iron and Steel Trades Employers' Association, and Sir Lewis Jones, secretary, South Wales Siemens Association; workers' representatives: Mr. Ambrose Callighan, member of the General Council of the T.U.C. and general secretary of the National Union of Blastfurnacemen, Ore Miners, Coke Workers and Kindred Trades, and Mr. Lincoln Evans, member of the General Council of the T.U.C. and general secretary of the Iron and Steel Trades Confederation.

Metal Trades Committee:—Government representatives: Mr. M. D. Tennant, assistant secretary, Ministry of Labour and National Service, and Mr. W. K. Ward, principal, Ministry of Supply; Mr. R. R. Bowman, permanent secretary, Ministry of Labour and National Insurance, Government of Northern Ireland, will accompany the Government representatives; employers' representatives: Mr. A. Collie Low, secretary, Engineering and Allied Employers' Federation, and Mr. W. Watson, secretary, Shipbuilding Employers' Federation; workers' representatives: Mr. Robert Openshaw, member of the Executive Council of the Amalgamated Engineering Union, and Mr. T. McKinney, president, United Society of Boilermakers and Iron and Steel Shipbuilders.

Personal

MR. H. J. PETTICAN, managing director of Laminated Springs, Limited, Halesowen, Worcs, has been elected president of Halesowen Rotary Club.

MR. J. L. FRANCIS is relinquishing his position as senior metallurgist to Foundry Services, Limited, Birmingham, in order to take up a position as technical director of Poole Foundry, Limited, Poole, Dorset.

MR. A. J. DOWNING, who commenced work at the Stour Valley Ironworks, Kidderminster, in 1886, has just retired from the firm of Richard Thomas & Baldwins, Limited, at the age of 74, after more than 60 years' service.

MR. JOHN CHARLES BURMAN, who is only 39 years of age, has been invited to become the Lord Mayor of Birmingham for 1947-48. He is a director of Charles H. Pugh, Limited, motor lawn mower manufacturers, of Birmingham.

MR. J. W. MORTIMER, who is retiring after 32 years as employment and welfare officer with Hadfields, Limited, Sheffield, was presented with a wallet of notes by Lord Dudley Gordon, chairman of the company, on behalf of the directors and staff.

MR. W. H. SIMMONS, a director of George Turton, Platts & Company, Limited, manufacturers of drop forgings, stampings, etc., of Sheffield, has retired from the position of secretary after 51 years' service with the company. He was presented with a silver tankard by Capt. J. C. Cowen, joint managing director.

DR. JOHN ERIC RICHARDSON, who became Principal of the Northampton Polytechnic, St. John Street, London, E.C.1, last month, in place of MR. S. C. LAWS, who retired after 22 years' service, is 41 years of age and was formerly Principal of the Royal Technical College, Salford. Dr. Richardson was also Principal of the Municipal Technical College, Oldham, from 1942 to 1944, and from 1933 to 1941 he was on the staff of the Hull Municipal Technical College, first as chief lecturer in Electrical Engineering and later as head of the Engineering Department. He holds the degrees of Ph.D. and B.Eng. of Liverpool and is a member of the Institution of Electrical Engineers and an associate member of the Institution of Mechanical Engineers.

Wills

WRIGHT, H. E., chief metallurgist to Dorman, Long & Company, Limited, Middlesbrough, since 1918...	£2,768
HOWIE, R. W., proprietor of Campbell & Company, Roughcastle Ganister and Fireclay Works, Camelon, Falkirk	£54,622

PLANS BY E. COX & SON to start a new factory in Kilkenny are being sponsored by the local Chamber of Commerce. The factory would produce articles of aluminium castings, tubular steel furniture, and garage fittings.

British Blast Furnaces in the June Quarter, 1947

These tables are published through the courtesy of the British Iron and Steel Federation.

Derby, Leicester, Notts, Northants and Essex.

Name of firm	In blast June 28, making:				Weekly average in blast		Total built	Furnaces relining
	Hematite	Forge and foundry	Basic	Total	June quarter	March quarter		
Clay Cross	—	1	—	1	1	1	1	—
Ford Motor	—	1	—	1	1	1	1	—
Kettering Coal & Iron	—	1	—	1	1	1	2	1
New Cransley Iron & Steel	—	1	—	1	1	1	2	1
Renishaw Iron	—	2	—	2	2	2	2	—
Sheepbridge Coal & Iron	—	2	—	2	2	2	2	—
Stanton Ironworks: Holwell	—	3	—	3	3	3	5	1
Stanton Gate	—	4	1	5	4.1	4.5	5	—
Staveley Coal & Iron	—	4	—	4	3.3	4	4	—
Stewarts and Lloyds: Corby	—	—	4	4	3.2	3.2	4	—
Wellingboro' Iron	—	—	2	2	2	2	3	1
Total	—	19	7	26	23.6	24.7	31	4

Lancashire (excl. N.-W. Coast), Denbigh, Flint and Cheshire.

Brymbo Steel	—	—	1	1	1	1	1	—
Darwen & Mostyn	—	—	—	1*	1	0.9	1	—
Lancashire Steel Corp'n.	—	—	2	2	2	2	3	1
Total	—	—	3	4	4	3.9	5	1

* Producing ferro-manganese.

North-West Coast.

Barrow Hematite	2	—	—	2	2	2	4	1
Charcoal Iron	—	—	—	—	0.5	0.8	1	1
Millom & Askam	2	—	—	2	1.9	2	3	1
North Lonsdale	—	—	—	—	—	—	4	—
Workington Iron & Steel	2	—	—	2	2	2	3	1
Total	6	—	—	6	6.4	6.8	15	4

Lincolnshire.

Appleby-Frodingham	—	—	6	6	6	7.1	10	1
Lysaght, J.: Normanby Park	—	—	3	3	2.7	2.5	3	—
Thomas, R., & Baldwins: Redbourn	—	—	2	2	2	2	3	—
Total	—	—	11	11	10.7	11.6	16	1

North-East Coast.

Cargo Fleet Iron	—	—	2	2	2	2	2	—
Consett Iron	1	—	1	2	2	2	2	—
Dorman, Long: Acklam	—	—	3	3	3	3	4	1
Redcar	—	—	—	—	0.9	2	2	2
Cleveland	—	—	3	3	3	3	5	2
Bessemer	—	—	3	3	3	3	3	—
South Bank	—	—	—	2*	2	2.5	4	2
Grangetown	—	—	—	—	—	—	2	—
Gjers, Mills & Co.	2	—	—	2	2	2	5	—
Pease & Partners	2	—	—	2	2	2	3	—
Skinningrove Iron	—	—	2	2	2	2	2	—
South Durham Steel & Iron	—	—	1	1	1.3	2	3	—
Total	5	—	15	22	23.2	25.5	37	7

* Producing ferro-manganese.

Scotland.

Bairds & Scottish Steel: Gartsherrie	1	1	2	4	4	4	5	—
Carron	—	1	—	1	1	1	4	1
Colvilles	—	—	2	2	2	2	2	—
Dixon, Wm.: Govan	—	1	—	1	1	1	6	—
Shotts Iron	—	—	—	—	—	2.2	—	—
Total	1	3	4	8	8	10.2	17	1

In Parliament

In the course of his reply to questions by VISCOUNT HINCHINGBROOKE, the MINISTER OF SUPPLY, said that the turnover for the year ended June 30, 1947, of Iron & Steel Disposals, Limited, was £10,030,359. In addition to the directors, 338 persons were employed, at a cost in salaries of £128,600 a year. During the year ended June 30, the company had disposed of 1,191,500 tons of iron and steel scrap. On June 30, the balance to be disposed of was approximately 260,000 tons, but of this the bulk was alloy-steel scrap, which could only be used in small quantities by the steel industry. Imports for the last 12 months amounted to 500,000 tons, almost the whole of which was imported by Iron & Steel Disposals.

National Foundry College

The new National Foundry College, which will be housed in the Wolverhampton and Staffordshire Technical College, Wolverhampton, is likely to be opened next November. This announcement was made by Mr. F. Lonsdale Mills, director of education for Wolverhampton Corporation, following the first meeting of the governing body of the College.

The College, which is the successor to the British Foundry School of pre-war days, is the only one of its kind in the country. It will be the centre of post-graduate teaching in the foundry industry.

Obituary

MR. ERIC WILLIAM LAWRENCE GARDNER, a director of L. Gardner & Sons, Limited, oil-engine manufacturers, of Patricroft, Manchester, died suddenly on July 26. He was 52.

MR. EDWARD LLOYD WYNYARD BELLHOUSE, who died recently at Charlton Marshall, near Blandford, Dorset, at the age of 89, was a director of the Hallamshire Steel & File Company, Limited. He joined the staff of Sanderson Bros. & Newbould, Limited, in 1881, later joining Thos. Firth & Sons, Limited. He formed the company of Laminated Gears, which was subsequently taken over by the Laycock Engineering Company, Limited.

MAJOR JOHN LAWRENCE BENTHALL, for many years a director of Vickers, Limited, died recently, aged 79. He began his career by entering the Thames shipbuilding business of Samuda Bros., Limited, in 1886, and was appointed assistant manager three years later. In 1892 Major Benthall joined Vickers, Sons & Company, Limited, becoming head of their armour department in 1895 and a director in 1910. He was a freeman of the Shipwrights' Company and was given the freedom of the City of London in 1924.

WILLIAM GRAY & COMPANY, LIMITED, West Hartlepool, who are building one vessel for the Irish Shipping Company, Limited, Belfast, have been engaged to build two more 9,000-ton cargo vessels for the same company with the promise of delivery in 1949.

British Blast Furnaces in the June Quarter, 1947—*continued*

Staffordshire, Shropshire, Worcestershire and Warwickshire.

Name of firm	In blast June 28, making: Hematite	Forge and foundry	Basic	Total	Weekly average in blast: June quarter	March quarter	Total built	Furnaces relining
Goldendale Iron	—	1	—	1	0.2	0.2	2	1
Glazebrook, M. & W.	—	—	—	—	—	—	2	—
Lilleshall	—	1	—	1	1	1	2	1
Round Oak Steelworks	—	1*	—	1	1	1	3	—
Shelton Steel & Iron	—	—	2	2	2.2	2	3	1
Stewarts and Lloyds: Bilston	—	—	—	—	—	—	3	1
Thomas, G. & R.	—	—	—	—	—	—	2	—
Total	—	3	2	5	4.4	4.2	17	4

* Cold-blast pig-iron.

South Wales and Monmouthshire.

Guest, Keen, Baldwins: Margam and Port Talbot	—	—	2	2	2	1.8	3	1
Briton Ferry	—	—	—	—	—	—	1	—
Cardiff	1	—	2	3	2.9	3	4	1
Thomas, R., & Baldwins: Ebbw Vale	—	—	2	2	2	2	3	1
Total	1	—	6	7	6.9	6.8	11	3

Sheffield.

Park Gate Iron & Steel	—	—	2	2	1.8	1	2	—
GRAND TOTAL	13	25	50	91*	89	94.7	151	25

* Includes three making ferro-alloys.

Number of Furnaces in Blast on June 28, 1947

District	Weekly average in blast, June quarter	Total in blast, June 28	In blast on June 28, making: Hematite	Forge and foundry	Basic	Ferro-alloys
Derby, Leics., Notts, Northants and Essex	23.6	26	—	19	7	—
Lancs. (excl. N.-W. Coast), Denbigh, Flint and Ches.	4	4	—	—	3	1
Lincolnshire	10.7	11	—	—	11	—
North-East Coast	23.2	22	5	—	15	2
Scotland	8	8	1	3	4	—
Staffs., Shrops., Worcs. and Warwick	4.4	5	—	3	2	—
S. Wales and Monmouth	6.9	7	1	—	6	—
Sheffield	1.8	2	—	—	2	—
North-West Coast	6.4	6	6	—	—	—
Total	89	91	13	25	50	3

Weekly Average Number of Furnaces in Blast During the Previous Six Quarters

District	1947 March	1946 December	1946 September	1946 June	1946 March	1945 December
Derby, Leics., Notts., Northants and Essex	24.7	25.8	23.5	22.2	21.6	21.2
Lancs. (excl. N.-W. Coast), Denbigh, Flint and Ches.	3.9	3.9	4	4.5	5	5
Lincolnshire	11.6	11.8	13	12.9	12.4	13.4
North-East Coast	25.5	26	26	25.8	25	25
Scotland	10.2	10.2	10	10	10	10
Staffs., Shrops., Worcs. and Warwick	4.2	5.8	7.8	8	8.5	8.9
S. Wales and Monmouth	6.8	6.9	6.6	6.8	7	6.9
Sheffield	1	1	1	1.4	2	2
North-West Coast	6.8	6.8	5.8	6.6	7	7
Total	94.7	98.2	97.7	98.2	98.5	99.4

New Furnaces Building (9)

The following companies have furnaces in course of construction:—Cargo Fleet, 1; Clay Cross, 1; Colvilles, 1; Consett Iron, 1; Darwen & Mostyn, 1; Lancashire Steel Corpn., 2; Lysaght, J., & Co., 1; Thomas, R., & Baldwins (Redbourn), 1.

News in Brief

DURING THE first seven months of this year, 25 ships of 112,627 gross tons were launched on the River Wear. If this rate of output is maintained, the river's output for the year will be slightly down on 1946. It is understood that there will be no launches on the Wear this month.

THE MACHINE TOOL AND ENGINEERING EXHIBITION, London, 1948, will be staged by the Machine Tool Trades Association at Olympia in August of next year. This will be the first exhibition of its kind to be held in London since the M.T.T.A. exhibition at Olympia of 1934.

OWING TO THE EXPANSION of their business in the London and South-Eastern area, Spencer & Halstead, Limited, Ossett, Yorks, have transferred their London office to larger premises at 8, West Street, Epsom, Surrey (telephone: Epsom 2201). The office is in charge of the area manager, Mr. H. H. Bridge.

AT THE INVITATION of the Belgian Royal Society of Engineers and Industrialists, and in concert with the Institution of Civil Engineers, the Institution of Mechanical Engineers, and the Institution of Electrical Engineers of London, 75 British engineers and students are visiting important Belgian industries.

A RECENT ANNOUNCEMENT regarding the proposed construction work for the Steel Company of Wales, Limited, stated that a contract had been entered into with Priest Furnaces, Limited, in respect of furnace work. This contract for the building of open-hearth furnaces will be jointly undertaken by Priest Furnaces, Limited, Middlesbrough, and G. P. Wincott, Limited, Sheffield.

ADDRESSING A trade-union conference at Motherwell, recently, Mr. Alex. Anderson, M.P., gave the assurance that the Steel Nationalisation Bill was already in hand and would probably be submitted to Parliament in October. He thought that in a year from now the steel trade would have passed from its present owners into the hands of the nation. The Government was not going back on its plans, he said.

STEEL MELTERS in four large Rotherham district branches of the Iron and Steel Trades Confederation have refused to accept the continuous working week plan of the Confederation, and the branches have been disbanded by the Confederation. The members say that they have no desire to impede production, but consider that the adoption of the continuous shift system cannot increase steel output without what amounts to "sweated labour."

THE SCOTTISH COUNCIL (DEVELOPMENT AND INDUSTRY) are to appoint a fully qualified officer to act for the Council in all scientific and technical matters. Sir Steven Bilsland, chairman of the Executive of the Council, stated that they were continuing to press for the devolution of Government research establishments and other research work to Scotland. In particular they were strongly urging the establishment in Scotland of the new mechanical sciences research laboratory.

SHAREHOLDERS MAY SHORTLY be given the opportunity of increasing their financial interest in the company, said Mr. J. E. Hodgkin, chairman, at the recent meeting of Barton & Sons, Limited, which holds all the share capital of Barton Conduits, Limited, and other companies. Plans for re-equipping the factories were proceeding, but the full expansion programme would be accelerated in the near future, it was hoped, when the necessary sanction had been obtained to an offer to shareholders.

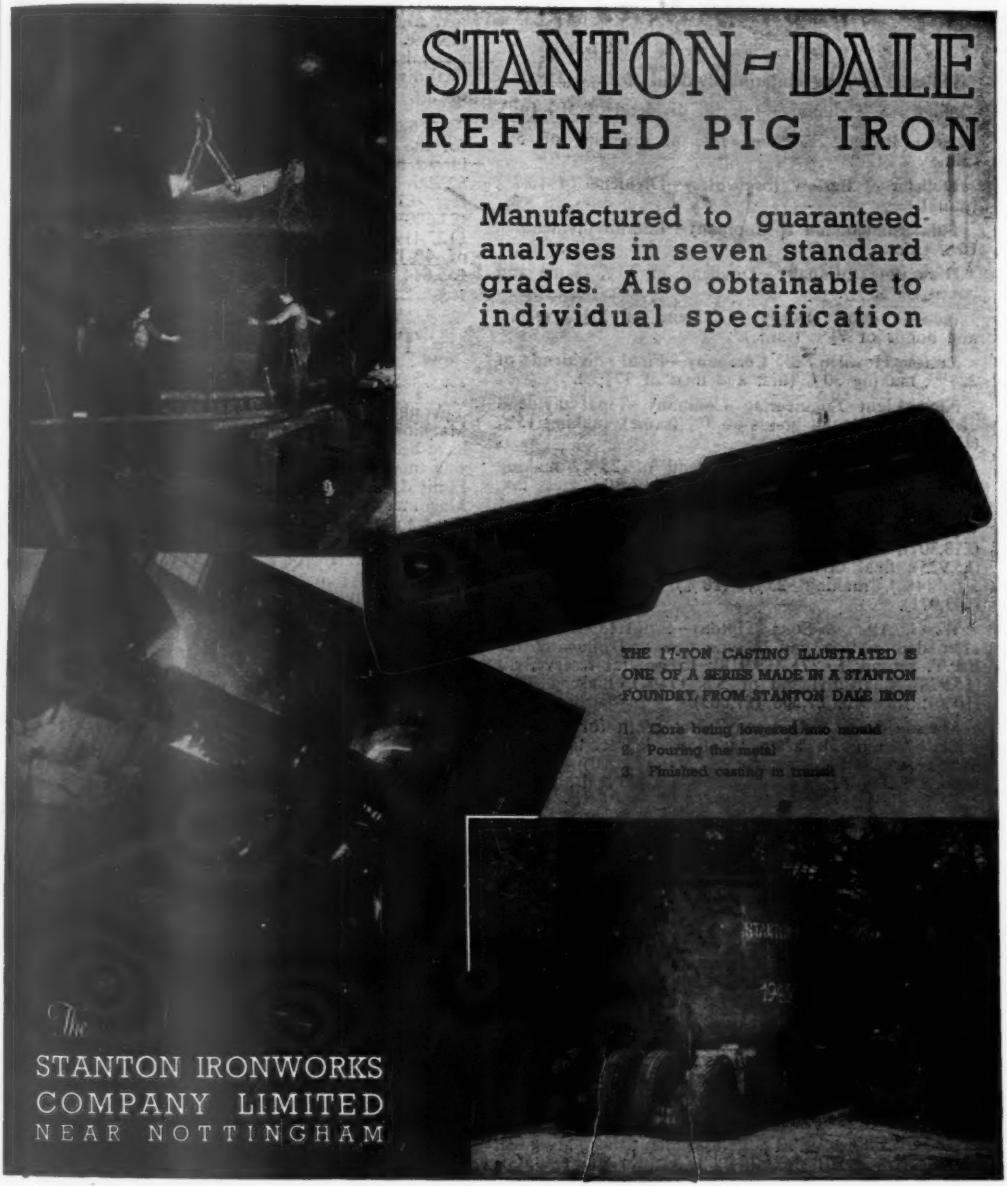
THREE NEW Wellman (patent) level luffing jib cranes, each of 15 tons capacity, have been installed at Le Havre. These were the first British post-war dockside cranes to be supplied to the French Government for re-equipping French ports devastated by the war. The cranes incorporate an entirely new principle of screw-operated level luffing motion resulting in speedier movements, lower running and maintenance costs and simplified control. Cranes of this type have also been supplied to Russia.

SIR HARRY RAILING, chairman of the General Electric Company, Limited, told shareholders at the recent annual meeting that the most pressing need of industry, because on it depended the whole production of the country, was to close the gap between demand and supply for coal, steel and power production. The second necessity was to increase the number of workers in the productive industries. The company had successfully changed over from the production of war materials to normal peace production, but was handicapped by the necessity to change its plans with the ever-changing picture dictated by national requirements.

TO FACILITATE THE fixing of maximum prices for certain goods, the Board of Trade, in consultation with the Central Price Regulation Committee, has adopted two official price control marks. The marks are shown in the Schedule to the Price Controlled Goods (Price Control Mark) Order, 1947 (S.R. & O., 1947, No. 1651, price 1d.), which came into operation on August 11. This Order does not authorise the application or use of the mark by any trader. This will be covered, as the occasion arises, by subsequent Orders or Directions. Where authorisation has been given, the inclusion of a cash price under the words "maximum price" in the mark on any goods will fix that price as the maximum for that particular article and override any other provision.

Economy in Copper Tubes

The Ministry of Supply has drawn attention to the need for economy in the weight of copper used in hot- and cold-water systems in buildings and to the importance therefore of using copper tubes only to the thicknesses laid down in B.S.S. 659/1944. Manufacturers have been requested to discontinue, as from August 11, the production of any copper tubes intended for use in hot- and cold-water systems in buildings which do not conform to this specification. The Ministry of Health has issued a similar instruction to local authorities and water undertakings.


STANTON-DALE
REFINED PIG IRON
Manufactured to guaranteed analyses in seven standard grades. Also obtainable to individual specification
THE 17-TON CASTING ILLUSTRATED IS ONE OF A SERIES MADE IN A STANTON FOUNDRY FROM STANTON DALE IRON
1. Core being lowered into mould
2. Pouring the metal
3. Finished casting in transit
The
STANTON IRONWORKS
COMPANY LIMITED
NEAR NOTTINGHAM

Company News

(Figures for previous year in brackets.)

Hillhead Hughes—Interim dividend of 2½% (3½%).

Shanks & Company—Interim dividend of 5% (nil).

John Bolding & Sons—Interim dividend of 5% (same).

Dobson & Barlow (Securities)—Dividend of 10.7% (same).

Falk, Stadelmann & Company—Interim dividend of 10% (same).

Dermatine Company—Dividend of 30% (same and bonus of 10%).

Newton Bros. (Derby)—Dividend of 17½% (same) and bonus of 7½% (same).

James Howden & Company—Final dividend of 22½%, making 30% (first and final of 17½%).

Nico Light Engineering Company—Final dividend of 10% (7½%) and bonus of 5% (same), making 15% (12½%).

Metal Closures—Final dividend of 25%, making 40% (final dividend of 17½%, making 30%, less tax, plus capital bonus of 10%, tax free).

Minimax—Net profit for 1946, after tax, etc., £24,487 (£18,307); written off patents, £204 (£3); to staff, £1,360 (£5,925); final dividend of 12% (8%) and bonus of 5% (4%), making 25% (20%); forward, £49,707 (£43,971).

W. G. Allen & Sons (Tipton)—Profit to March 31, after depreciation and income tax, and allowing for E.P.T. refund, £7,271 (£9,918); to general reserve, nil (£5,978); final dividend of 5% (7½%), making 7½% (10%); forward, £7,208 (£7,065).

Masson Scott & Company—Net profit for the year ended March 31, after taxation, depreciation, etc., £7,573 (£5,284); to reserve, £1,500 (£2,000); pension fund, £1,000 (nil); dividend of 5% (same) and bonus of 1½% (same); forward, £5,348 (£4,572).

Duple Motor Bodies—Profit for the 8½ months to March 31, after depreciation, etc., £119,085; to income tax, £52,282; future taxation, £20,000; final dividend of 10.6%, making 14.2%; forward, £11,740. (The company was made public in July, 1946.)

British Vacuum Cleaner & Engineering Company—Net profit for the year ended September 30, 1946, after income tax, N.D.C., depreciation, etc., £45,005 (£44,752); to tax reserve and N.D.C., £24,000 (£22,000); dividend of 20% (same); forward, £14,832 (£14,658).

Tredegar Iron & Coal Company—Net profit for the nine months to December, after depreciation, etc., £124,762 (£143,238 for year); no credit taken for interim income in respect of the quarter ended March 31; dividend of 9% (same) on the "A" and "B" shares; forward, £140,544 (£101,283).

Gerrard Industries—Trading profit for the year ended March 31, £24,918 (£25,394); to depreciation, £3,021 (£2,831); directors' fees, £1,473 (£1,647); N.D.C., profits tax, £1,500 (same); net profit, £18,924 (£19,416); other income, £6,391 (£7,371); to tax, £10,412 (£12,000); general and dividend equalisation reserve, nil (£5,000); final dividend of 10%, making 20% (same), and a bonus of 5% (same); forward, £7,778 (£2,960).

Richardsons, Westgarth & Company—Trading profit for the year ended March 31, after taxation and deferred repairs, £181,188 (£143,508); royalties received, £2,996 (£585); interest, £3,477 (£2,360); to directors' fees, £2,400 (same); bank interest on loan, £2,357 (£3,600); depreciation, £55,485 (£53,120); net profit, £127,419 (£87,333); dividend of 10% (8% and bonus of 4%); general reserve, £60,000 (£50,000); forward, £55,644 (£46,614).

Textile Machinery Makers' Directorate

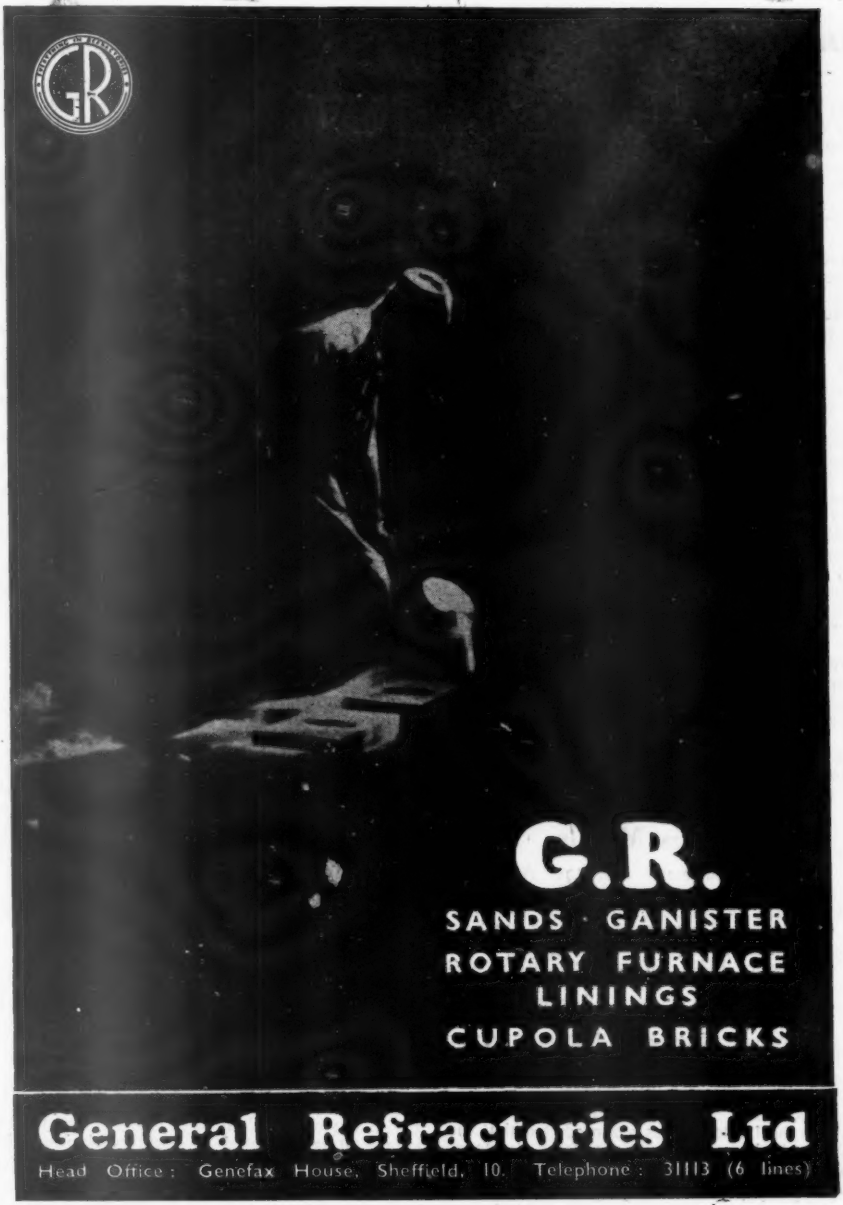
A number of changes in the boards of Textile Machinery Makers, Limited, and associated companies have been announced. Mr. Stanley H. L. Greaves, who was managing director of Platt Bros. & Company, Limited, as well as managing director of Textile Machinery Makers, retires from the former appointment to devote his whole attention to the affairs of T.M.M. Mr. George A. Phillips has been appointed managing director of Platt Bros. & Company, with Mr. Peter A. Rippon as deputy managing director. Mr. A. P. H. Aitken becomes deputy managing director of T.M.M., retiring from the position of managing director of Howard & Bullough, Limited. Mr. Robert Douglas is co-opted to the board of T.M.M. and becomes director of production, retiring from the position of managing director of Dobson & Barlow, Limited. Mr. James Redman has been appointed director of sales and Mr. Frank Heywood, the chief research officer, as director of research of T.M.M.

Other appointments in the group are as follow:—Mr. Harry L. Greaves as managing director of Howard & Bullough, Limited, in place of Mr. A. P. H. Aitken; Mr. Walter Hartley, managing director of Dobson & Barlow, Limited, in place of Mr. R. Douglas, with Mr. Anthony R. B. Dobson as deputy managing director; and Mr. F. W. Smith as managing director of Asa Lees & Company, Limited. Mr. Gilbert Varley has resigned from the board of T.M.M.

Contract Open

The dates given are the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

South Kesteven, August 27—Supply and laying of approx. 37 miles of spun-iron trunk and distribution water mains, etc., for the Rural District Council. G. B. Kershaw & Kaufman, consulting engineers, 1, Victoria Street, Westminster, London, S.W.1. (Fee £5 5s., returnable.)


G.R.
SANDS · GANISTER
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LININGS
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General Refractories Ltd
Head Office: Genefax House, Sheffield, 10. Telephone: 31113 (6 lines)

Raw Material Markets

Iron and Steel

It would appear to be the official policy to give priority to the expansion of basic-iron production, so as to facilitate a bigger output in the melting shops. In this direction progress should not be long delayed. But the foundries, too, are pressing for bigger tonnages of pig-iron, and something will have to be done about it very soon. Apart from the hold up of the housing programme, to which the shortage of castings is a contributory factor, there are many branches of the engineering trades in which operations are delayed by the bottlenecks in the foundries, and these difficulties cannot be overcome until more pig-iron is available.

The Control is endeavouring to share out supplies as equitably as possible. Exports are banned, purchases are limited to two months ahead, and those with even moderate stocks must take a back place in the queue. Obviously more pig-iron is wanted, and the sooner it can be provided the speedier will be the revival in many branches of industry.

Repercussions of the dollar crisis on the imports of steel semis have yet to be clearly defined. If it means the stoppage or the further curtailment of American and Canadian supplies the effect on the re-rolling industry will be lamentable. Deliveries of billets and sheet bars are already inadequate, and home producers are unable to provide the tonnages required to keep the sheet, bar and light section mills in full operation.

The weight of orders in hand for plates, sheets, joists and sections is so formidable that there is little scope for the acceptance of further business for delivery earlier than Period I of 1948. Moreover, there are lively apprehensions of a further rise in prices in the autumn, the trend of the market being plainly indicated by the advance of $5 per ton which has recently been announced in the United States. Under present conditions price changes seem to have no visible effect on demand, but inflation is no less an evil if its immediate effects are concealed.

Non-ferrous Metals

Reports from Sydney state that the Australian Government is arranging to buy Rhodesian copper to supplement domestic production, which is estimated to be falling short of local requirements by as much as 15,000 tons. Australian output of copper concentrates has been falling since 1944. In that year 28,056 tons were produced, while output last year had fallen by 10,301 tons to only 17,755 tons. Requirements of Australian industry are estimated at almost 33,000 tons for this year. The cost of importing Rhodesian copper is about £180 a ton, as against the maximum price of £130 a ton which local producers are permitted to charge.

It is reported from Washington that the Bolivian Ambassador to the United States has predicted that the U.S. will pay a higher price for tin under a new contract to be negotiated between the two countries within a few months. He is also reported to have stated that the United States would likely request a larger share of the Bolivian tin output, which at present also goes to Great Britain and Argentina.

World ore production (tin content) in the first five months of 1947 is estimated by the International Tin Research and Development Council at 40,000 tons, corresponding to 34 per cent. of the world estimated production of 117,000 tons. Apparent consumption in the five months is estimated at 52,000 tons, which is about 10 per cent. higher than that of the corresponding period of 1946. Owing to exports from Bolivia having been much smaller latterly than normal, U.K. and U.S.A. stocks have sharply decreased in the same period by 17,500 tons. On the other hand, stocks in the Netherlands and Belgium have gone up by 6,300 tons.

Mr. C. H. Crane, chairman of the St. Joseph Lead Company, one of the biggest lead-producing concerns in the United States, has stated that he expects the lead situation to remain reasonably in balance over the remainder of the third quarter. He added that there has been recently a moderate slow-down in demand as a result of summer industrial vacations, but this was offset by a drop of 60,000 tons in smelter and Government stocks of lead. Mr. Crane said, however, that he did not feel it proper or safe to predict for more than a few months ahead, particularly with world conditions as uncertain as they are to-day.

Butterley Company May Build New Foundry

The percentage of wasters in their foundry had fallen to a record low level, said Mr. E. Fitzwalter Wright, chairman of the Butterley Company, Limited, at the recent annual meeting. They were considering the building of an entirely new foundry at Butterley.

All their purely colliery assets, of course, had passed to the National Coal Board without option, but it was clear that they would retain their ironworks at Butterley and Codnor Park, together with their civil-engineering department and two out of the three brickworks. What would happen to the ironworks if the iron and steel industry was nationalised was, of course, uncertain, but Mr. Wright said he saw no reason to change the view he expressed last year that, with the possible exception of the forge, they were unlikely to be included in the nationalisation scheme.

MIDDLESBROUGH TOWN COUNCIL has accepted the tender of Cochranes (Middlesbro') Foundry, Limited, for the supply of pipes and specials for a new 24-in. dia. trunk main. The accepted price for 24-in. spun-iron pipes—subject to the usual rise and fall clause—is £3 13s. 2d. per yd.

NEWCASTLE-UPON-TYNE CITY COUNCIL is being recommended to allocate land in Fossway, Newcastle, to C. A. Parsons & Company, Limited, for works extensions. It is proposed to begin work immediately on the erection of two bays costing £80,000, and eventually about £750,000 will be spent on the site.